Unusual Bone-Scan Findings in Acute Osteomyelitis: Case Report

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In osteomyelitis, bone-scan findings precede the appearance of bone changes on radiographs. In cases where focal ischemia occurs, the earliest scan finding may be a "cold" area that later becomes "hot" as active periostitis develops.

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The value of the bone scan in diagnosing osteomyelitis has been well established by previous studies (*1–6*). Positive scan findings usually precede positive radiographs by several days. The usual finding is a localized "hot" area of increased activity that corresponds well with the area of osteomyelitis defined on subsequent radiographs. This report describes a case of osteomyelitis of the femur which was first recognized as a "cold" area and which later became "hot."

CASE REPORT

A previously healthy 20-month-old boy developed cellulitis and septicemia from an infected cigarette burn. Five days after the burn, his thigh and knee had become markedly inflamed and pus was aspirated near the knee joint. Radiographs of the leg (Figs. 1A and 1B) showed soft-tissue swelling but no bone abnormality. Pyarthrosis was diagnosed and a ^{99m}Tc-pyrophosphate bone scan was obtained to evaluate the possibility of osteomyelitis. The scan showed an area of decreased uptake in the distal metaphysis of the femur (Fig. 1C); this was ascribed to localized ischemia.

At surgical exploration the periosteum of the distal metaphysis was found to be circumferentially ele-

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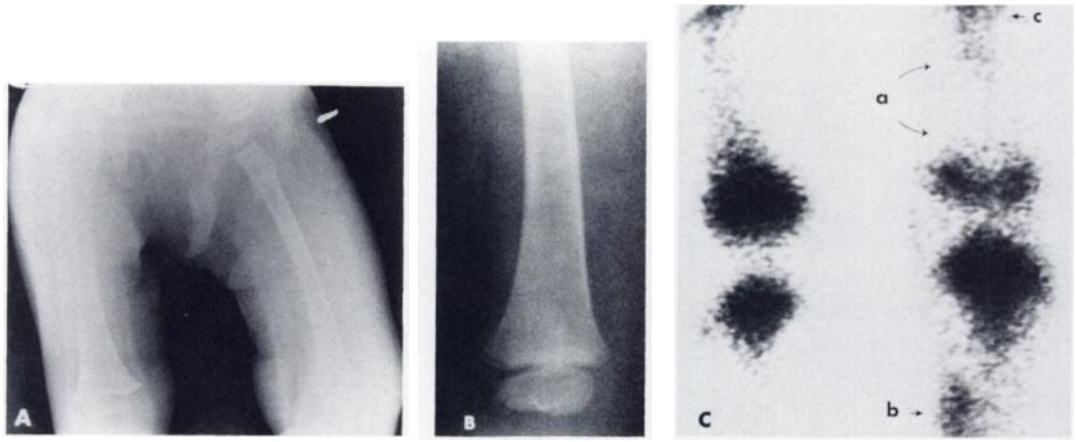

FIG. 1. (A) Initial radiograph shows soft-tissue swelling in left thigh. (B) Closeup view of distal left femur shows no bone abnormality. (C) Anterior ^{99m}Tc-pyrophosphate scan of both knees shows decreased activity in distal metaphysis of left femur (a). Note injection artifact in left calf medially (b) and edge-packing artifact in femur (c). Subperiosteal pus surrounding distal left femoral metaphysis was drained immediately after this study. Arteries to distal metaphysis were found to be occluded.

vated by thick pus, dissecting 10 cm up the shaft. The pus was evacuated with drains; the infecting organism was found to be *Staphylococcus aureus*. The surgeons reported that the nutrient arteries entering the distal metaphysis through the periosteum were occluded (*7*).

Repeat scans at 1 week after surgical drainage (Fig. 2B) showed increased activity along the shaft of the left femur, extending down around the previously noted "cold" area in the metaphysis. Radiographs at that time (Fig. 2A) revealed minimal focal osteolysis of the distal metaphysis. Scans at 2 weeks (Fig. 3B) showed further increased activity in areas where the radiographs now revealed an early periostitis (Fig. 3B). A scan at 5 weeks showed a uniformly "hot" distal femur (Fig. 4B), and radiographs at that time (Fig. 4A) suggested further periosteal reaction, involucrum formation, osteoporosis, and fragmentation. The tibia developed moderate osteopenia but was otherwise normal. The relative increase in activity in the proximal tibial epiphysis may be due to hyperemia of the knee.

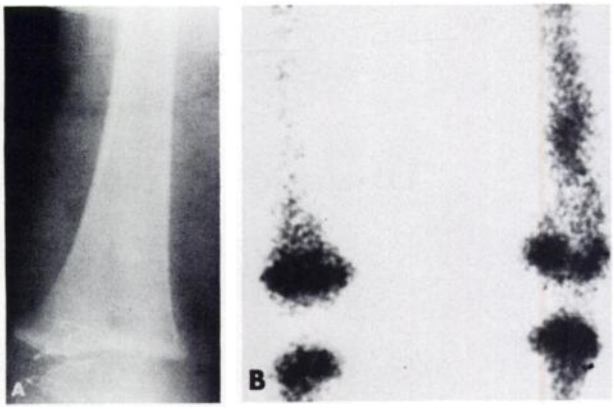

FIG. 2. (A) Radiograph of distal left femur 1 week after surgery shows minimal osteolysis of medial metaphysis. (B) Bone scan 1 week after surgery shows increased activity in left femoral shaft extending into metaphysis.

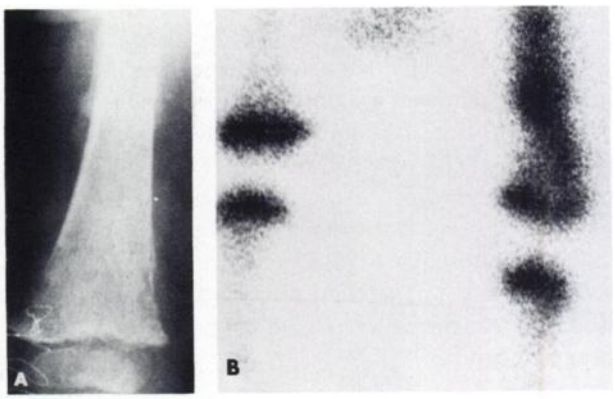

FIG. 3. (A) Radiograph of distal left femur 2 weeks after surgery shows early periostitis in shaft and metaphysis and further osteolysis of medial metaphysis. (B) Bone scan 2 weeks after surgery shows further increased activity in left femur. There is activity in child's diaper.

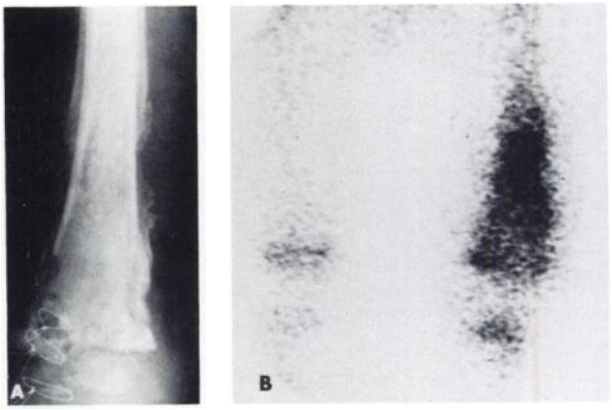

FIG. 4. (A) Radiograph of distal left femur 5 weeks after surgery shows active periostitis suggesting involucrum formation, osteoporosis of distal epiphysis, and early fragmentation of distal metaphysis. (B) Bone scan 5 weeks after surgery shows uniformly increased uptake in distal left femur and increased activity in proximal tibial epiphysis.

DISCUSSION

Classical hematogenous osteomyelitis begins in the metaphysis of long bones. In children, *Staphylococcus aureus* is the usual causative agent (above 80%). Our present case illustrates what may be the earliest bone-scan finding in osteomyelitis where focal ischemia is a feature: an area of decreased activity on the scan. Osteomyelitis may or may not produce sizable areas of ischemia, depending on the location and mechanism of spread of the infection. Presumably, the involvement of the metaphyses of long bones is secondary to their relatively sluggish blood flow. Inflammation there is thought to result in ischemia and, as the infection spreads through the cortex and forms a subperiosteal abscess, the nutrient arteries may be compromised (*8*). Consequently a radiopharmaceutical in the blood stream will not have access to its usual areas of uptake in the metaphysis and epiphysis, and a "cold" area is seen on the scan.

The subsequent "hot" region reflects increasing osteoblastic activity in the periosteum that is not devascularized, and new bone formation is shown by x-ray within several days. Perhaps as bone scans are utilized more frequently and earlier in the course of this disease, initial "cold" areas will be seen more often.

Addendum. Since this article was submitted for publication, another case of osteomyelitis with similar bone-scan findings has been reported by H. Handmaker in *Seminars in Nuclear Medicine* (6: 95–106, 1976).

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INTERNATIONAL SYMPOSIUM ON COMPUTER-ASSISTED TOMOGRAPHY

An international symposium on "Computer-Assisted Tomography in Nontumoral Diseases of the Brain, Spinal Cord, and Eye," sponsored by the National Institute of Neurological and Communicative Disorders and Stroke, is announced. The meeting will be held at the Clinical Center on the campus of the National Institutes of Health, Bethesda, Maryland, on October 12–15, 1976, under the chairmanship of Giovanni Di Chiro, M.D.

The topics will include the physics, technologies (various devices and modalities), and the clinical (morphologic and functional) aspects of transmission and emission computer-assisted tomography of the brain, spinal cord, and eye, with emphasis on nontumoral diseases.

Investigators are invited to submit detailed and documented abstracts (with data and illustrations). Inclusion in the program will be established solely on scientific criteria. The deadline for submission of abstracts is August 1, 1976.

Scientific and technical exhibits are planned.

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